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Orbital evolution and search for eccentricity and apsidal motion in the eclipsing HMXB 4U 1700–37

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In the absence of detectable pulsations in the eclipsing High Mass X-ray binary 4U 1700–37, the orbital period decay is necessarily determined from the eclipse timing measurements. We have used the earlier reported mid-eclipse time measurements of 4U 1700–37 together with new measurements from long term light curves obtained with the all sky monitors RXTE–ASM, Swift–BAT and MAXI–GSC, as well as observations with RXTE–PCA, to measure the long term orbital evolution of this binary. The orbital period decay rate of the system is estimated to be ‘P/P = –(4.7 ± 1.9) × 10ˆ{–7} yrˆ{–1} , smaller compared to its previous estimates. We have also used the mid-eclipse times and the eclipse duration measurements obtained from 10 years long X-ray light curve obtained with Swift–BAT to separately put constraints on the eccentricity of the binary system and attempted to measure any apsidal motion. For a reasonable rate of apsidal motion for this binary system, the eccentricity is found to be less than 0.008, which limits our ability to determine the apsidal motion rate from the current data. We discuss the discrepancy of the current limit of eccentricity with the earlier reported values from radial velocity measurements of the companion star.

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